

The Formation of Small-scale Forestry in Countries with Economies in Transition: Observations from Lithuania

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Lithuania has been undergoing a transition from one political culture (based on a centrally planned economy and a one-party system) to a radically different political culture (market economy and a democratic political system). After the declaration of independence in Lithuania, some new phenomena emerged in forestry: the privatisation of forest industry, the formation of a free timber market; increasing timber export levels; and new modes of ownership (private forests) and enterprise (private business logging companies). Private forest owners control approximately 680,000 ha of forest, 33% of the total forest area, projected to increase to 40-45% in the future. Small-scale private forestry is developing in Lithuania but there is a lack of information about the objectives and problems of private forest owners. This paper presents the main results of a survey carried out in 2004 by the Lithuanian Forest Research Institute. The most important forest ownership objectives are firewood production for home consumption, income generation from wood and non-wood product sales, and protection of nature and biodiversity. The main problems for private forest owners are that the forest properties are too small to achieve efficiency, owners lack money for silviculture activities and there is a heavy bureaucratic system for forest-related activity documentation. A cluster analysis of respondents' ratings of importance for various forest management objectives reveals four groups of private forest owners. These groups are named according to their dominant management objective, as multi-objective owners, businessmen, consumers and ecologists.

Keywords: forest management objectives, forest management problems, cluster analysis, groups of forest owners

INTRODUCTION

The level of private ownership of forests changed continually in Lithuania during the 20th century and is still changing today. Private forest ownership dominated until 1920, when private owners controlled about 65% of the total forest area in the country. In the period from 1919-1937, 600,200 ha of private forest were transferred into state forest. In 1938 private forest constituted only 173,000 ha (about 16% of

total forestland area). During 1940 a share of the private forests was nationalised by the Soviet governance. From 1950 to 1990, private forest ownership was avoided in Lithuania but after the declaration of independence in 1990 forest property rights were restored. According to the *Forest Act of the Lithuanian Republic, 1994*, forests are divided into state and private forests. The structure of forest ownership has changed due to a continuing land reform process, which commenced more than 10 years ago.

The private forest sector today constitutes 231,878 private forest owners, with 148,926 forest estates covering 684,451 ha of forest (Table 1). This is 33% of the total forest area, a proportion that is projected to increase to 40-45% in the future. Small-sized private forest properties are common in Lithuania. The average size of a forest estate is 4.6 ha (State Forest Survey Service 2005). Private forest owners differ according to age, gender, education, social status, area of private property and other characteristics. All these characteristics determine the goals and problems of private forest owners, thereby making it difficult to formulate policies to account for the variations. In spite of the great variety of forest owners in Lithuania, it is possible to group them according to their attitudes towards the management of their private property. Such grouping is necessary for forming and implementing policy for private forestry development in Lithuania.

Table 1. Private forestland area by owners and forest estates

Date	Area of forestland (ha)	Number of private forest owners	Number of private forest estates	Average private forest estate (ha)
1 Jan 2002	518,277	162,088	153,391	3.4
1 Jan 2003	586,036	183,365	130,412	4.5
1 Jan 2004	641,900	208,881	141,426	4.5
1 Jan 2005	684,451	231,878	148,926	4.6

Source: Ministry of Environment (various years).

The research reported in this paper is related to the recent land restitution in Lithuania and the need for knowledge about who these new forest owners are, in order to be able to govern forestry. The aim of this research has been to identify forest ownership objectives and forest management problems and to group the Lithuanian forest owners according to their objectives by applying a cluster analysis to survey data. This paper reports survey information about private forest owner's objectives and forest management problems. The results of the cluster analysis are reported and the main differences between the clusters are highlighted.

RESEARCH METHOD

Private property in western European countries has a long tradition, influenced by economic, ecological and social factors. In some western European countries the

typology of private forest owners has already been examined; however, each country has its own unique typology of private forest owners. The typology of a country's private forest owners depends on the characteristics of the owners and their properties, on the private forest ownership traditions, and on social, economic and ecological factors.

In Finland, private forest owners have been divided into four groups according to ownership objectives: recreationists, self-employed owners, investors and multi-objective owners (Karppinen 1998). *Recreationists* emphasise the non-timber and amenity aspects of their forest ownership, such as outdoor recreation, aesthetic considerations and berry-picking. *Self-employed owners* value regular timber sales, labour income from delivery sales (the seller does the logging and hauling), and employment provided by their forests. The importance of household timber is also emphasised. *Investors* regard their forest property as an asset and a source of economic security, such as security against inflation and for old age. Bequest motives are also emphasised. *Multi-objective owners* value equally both the short-term and long-term monetary benefits as well as the amenity benefits of their forests. In Denmark, three private forest owner groups have been identified: classic owners, hobby owners and indifferent farmers (Boon *et al.* 2004).

Lönnstedt (1997) compiled a qualitative study presenting the goals emerging from forest owners in Sweden. These are divided into five classes: formal economic goals; informal economic goals; production; environmental goals and intangible goals. *Formal economic* goals include the categories of cash flow, liquidity reserve and capital growth, while hunting, firewood and wood for household purposes are included among the *informal economic goals*. The *production goals* include the various silvicultural methods and aesthetics. *Intangible goals* include a preferred lifestyle, whilst the *environmental goals* are not discussed. According to Hugosson and Ingemarson (2004), the motivations and objectives were described and structured according to the information obtained during interviews. Four motivations emerged containing 15 abstracted objectives of small-scale forest owners in Sweden, including production, amenities, conservation and economic efficiency.

The investigations conducted on the private forest owners' typology in foreign countries cannot be adapted directly to the specific Lithuanian conditions. However, they are critical for the methodological aspect. The methodology adopted in this research is based on previous studies of the objectives, values, motivations and problems of forest owners carried out in other countries (Kuuluvainen and Karppinen 1996, Ripatti and Järveläinen 1997, Lönnstedt 1989, 1997, Karppinen 1998, 2000, Lidestav and Ekstrom 2000, Kline *et al.* 2000, Härdter 2002, Boon *et al.* 2004 and Hugosson *et al.* 2004). The methods and results presented in these studies were used as a source of information and experiences for the design and implementation of the survey in Lithuania.

In Lithuania, surveys of private forest owners' objectives and problems had been conducted by other authors (Pivoriūnas and Lazdinis 2004, Dudutis and Kupstaitis 2004), who reported similar findings to those presented in this paper. These other studies did not, however, include a statistical analysis of the survey responses.

The investigation was conducted in all 10 Lithuanian counties using personal interviews. The respondents were randomly selected from the database of the public company 'Registru Centras', which maintains data on all forest owners in Lithuania. A target sample size of 600 was chosen, based on the chosen accuracy requirement

and following the method outlined in Kardelis (1997). Referring to the results of earlier interviews (reported by Mizaraite 2001) and previous experience, 11% more respondents were selected than defined in the original selection group for the survey. In total, 670 respondents were randomly selected for the survey and a final usable sample of 601 forest owners was obtained. The distribution of private forest owners and the number of respondents according to counties is presented in Table 2. Twelve selected respondents refused to take part in the survey due to personal reasons and 10 questionnaires were rejected due to inadequate answering of questions.

Table 2. Distribution of private forest owners and respondents according to the counties

County	Private forest owner population		Sample size
	N	Fraction (%)	n (+11%)
Alytus	30,655	14.30	86 (+10)
Kaunas	23,469	10.95	66 (+8)
Klaipėda	13,902	6.48	39 (+4)
Marijampolė	6,207	2.89	17 (+2)
Panevėžys	26,252	12.25	74 (+8)
Šiauliai	17,879	8.34	50 (+6)
Tauragė	11,931	5.57	33 (+4)
Telšiai	15,762	7.35	44 (+5)
Utena	33,452	15.60	94 (+11)
Vilnius	34,875	16.27	98 (+11)
Total	214,384	100.00	601 (+69)

The questionnaire contained 26 questions, covering the following topics:

- characteristics of forest owner (age, gender, residence, occupation, education, duration of ownership, decision making);
- characteristics of forest holding (holding size, acquisition of holding);
- management activities in the forest holding (forestry-related activities, organising methods and forestry-related problems);
- management objectives (timber for selling, timber for fuel, non-wood products, hunting); and
- forest ownership problems (lack of funds and experience, consultants not qualified).

The survey information was analysed and grouped using cluster analysis. The management objectives were the main feature for the grouping. Respondents ranked their management goals in order of importance. All ownership objectives were marked using the same five-level ordinal Likert scale, presented in Table 3.

Table 3. Survey question used for cluster analysis

Question	Percentage of answers					
	1	2	3	4	5	
How important is each of the following forest ownership objectives to you?	Absolutely not important	Not important	Neither important nor unimportant	Important	Very important	Not marked
Income generation from wood and non-wood products sales	17.3	5.9	10.2	6.9	38.1	21.6
Round wood production for home consumption	17.8	5.6	10.0	8.9	35.0	22.7
Firewood production for home consumption	15.7	4.8	9.0	8.3	45.5	16.7
Recreational use	44.0	6.0	6.3	2.6	8.4	32.7
Forest holding used for hunting purposes	50.0	3.6	5.2	2.5	5.7	33.0
Non-wood products used for home consumption	25.0	7.1	10.7	8.9	23.6	24.7
Protection of wildlife habitat	19.5	7.1	9.9	8.3	27.6	27.6

For the cluster analysis, data from 415 questionnaires only were used because some of the respondents did not indicate the importance of some management goals. The K-means cluster analysis procedure of the STATISTICA software package was used. The clustering procedure as adopted here proceeds through several stages:

1. Cases are divided into k primary clusters.
2. The distance of every object to the centre of clusters is counted in sequence. Distance is calculated by using a Euclid metric square. An object is allocated to the closest cluster and the centres of the clusters are recalculated.
3. Step two is repeated until there is no more redistribution.

With the help of the cluster analysis, a typology of private forest owners was formed according to their management objectives. Each forest owner was placed into one of the clusters according to chosen socio-demographic characteristics. Forest management problems differ between clusters. The null hypothesis is that all four groups of private forest owners have the same types and importance of forest management objectives. A Kruskal-Wallis ANOVA test was applied, with significance at the 5% level assessed using Bonferroni paired comparisons of means.

THE FOREST OWNER TYPOLOGY

The cluster analysis based on the management objectives of the respondents revealed four distinct groups of private forest owners, namely 'businessmen', 'multi-objective owners', 'consumers' and 'ecologists'. The management objectives used for the classification (listed in Table 3) are numbered as AV1 to AV7.

Table 4. Owner and forest characteristics by owner cluster

Characteristic	Business-men	Multi-objective owners	Consumers	Ecologists	p-level
Women (%)	40.3	42.5	57.4	52.0	0.046
Men (%)	59.7	57.5	42.6	48.0	
Mean age (yrs)	50.9	53.7	55.4	50.3	
Professional education:					
University degree (%)	41.88	26.98	28.57	62.67	0.000
College level (%)	23.08	22.22	26.37	14.67	
Professional, comprehensive school and other education	35.04	50.05	45.05	22.67	
Mean duration of ownership (yrs)	4.98	5.62	5.62	5.53	
Counties by forest coverage (%) ^a					
Group I	31.93	38.89	23.40	17.33	0.001
Group II	35.29	15.08	31.91	34.67	
Group III	32.77	46.03	44.68	48.00	
Type of ownership					
One person (%)	74.79	76.19	75.53	76.00	
Owner with co-owners (%)	25.21	23.81	24.47	24.00	
Residence of owner					
Reside in city or town (%)	64.71	44.44	38.71	81.33	0.000
Reside in village (%)	35.29	55.56	61.29	18.67	
Mean forest area (ha)	13.37	14.97	6.92	9.86	
Mean distance from forest estate to residence (km)	44.7	35.4	18.5	58.5	0.000
Manner by which the forest estate has been acquired					
By buying	27.35	21.60	11.70	25.68	0.04
By restitution	50.43	42.40	40.43	44.59	
Through inheritance or as gift	25.64	37.60	43.62	28.38	0.024
Given as compensation instead of other property (e.g. instead of agricultural land) and other cases	11.97	9.60	10.64	8.11	
Conducting of silvicultural measures:					
Yes	71.19	76.80	72.34	60.00	0.030
No	28.81	23.30	27.66	40.00	
Silvicultural activity index ^b	2.5	2.2	1.6	2.0	0.003
Forestry-related knowledge index ^c	0.93	1.2	1.2	0.9	0.025

a. Counties by forest coverage: Group I – Šiauliai (25.8%), Klaipėda (23.3%), Marijampolė (21.0%); Group II – Tauragė (29.7%), Kaunas (29.1%), Panevėžys (27.2%); Group III – Alytus (48.9%), Vilnius (43.6%), Utena (32.7%), Telšiai (32.7%).

b. From 0 = no activity, to 7 = on average 7 different activity types (e.g. sanitary cutting, clear-cutting).

c. From 0 = no knowledge about forest management, to 4 = a good knowledge about forest management.

The main characteristics of clusters are reported in Table 4, and the mean scores of the various forest owners' management objectives for each cluster are presented in Figure 1. The cluster '*businessmen*' is represented by forest owners for whom income from wood sold and non-wood products is the main objective of forest management. This is the second biggest cluster with 119 members. The forest

owners in this cluster (and also the ‘*multi-objective owners*’) own the largest forest properties. Forest owners in this cluster on average own forest properties of 13.4 ha. About 65% of owners reside in cities and the average distance from the forest holding to their residence is 44.7 km. The average age of the owners in this group is 50.9 years. The ‘*businessmen*’ group has the shortest forest ownership time with an average of 4.9 years. However, the silvicultural activity index is higher than in other clusters, at 2.5¹. Even though their knowledge of forestry is not the greatest, the forest owners’ forestry-related knowledge index is 0.93².

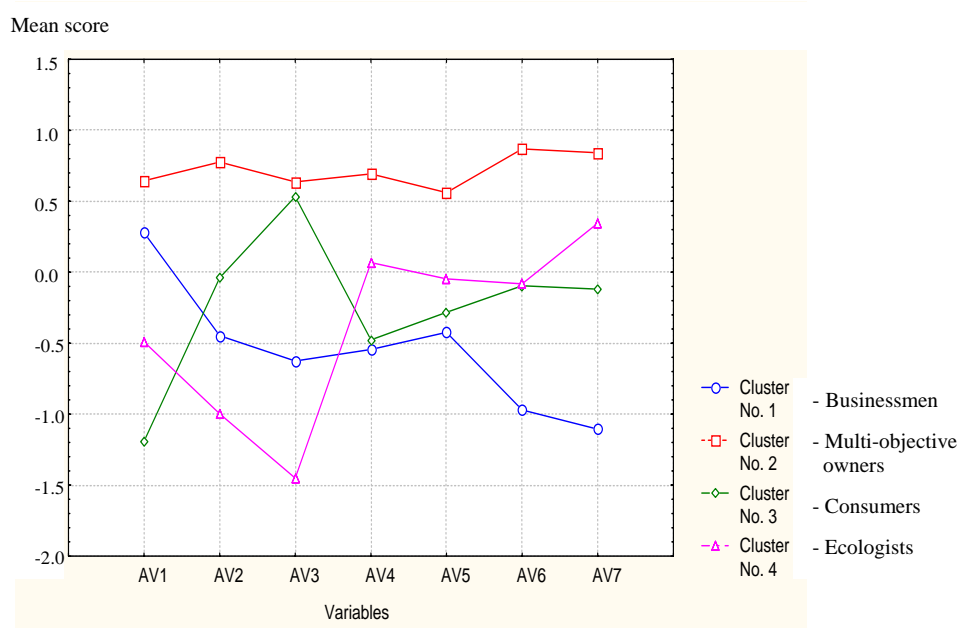


Figure 1. Mean response values for four clusters

The ‘*multi-objective owners*’ form the largest cluster, with 127 members. Forest owners in this cluster own the largest forest properties, on average 14.9 ha. About 46% of these owners reside in the most forested counties (Alytus, Utena and Vilnius); 55.6% live in the countryside and the average distance from the forest estate to their residence is 35.4 km. The average age of owners in this group is 53.7 years and the average period of possessing their forest property is 5.6 years. The silvicultural activity index is 2.2. Owners representing this cluster are conducting moderate silvicultural measures. The forestry knowledge of the owners in this cluster (and also in the ‘*consumers*’ cluster) is the highest, with an index of 1.2.

¹ Forest owners indicated seven different forestry-related activities. The silvicultural activity index is the number of these activities performed. For example, if the private forest owner undertook two activity types (e.g. sanitary cutting and reforestation), the silvicultural activity index would be 2.

² Forest owners indicated four different levels of knowledge about forest management (forester, attended special course for private forest owners, use special literature and material for private forest owners, and other experience or information sources).

Only 23.8% co-own forest holdings with other owners, which is less than in other clusters.

For the '*consumers*' cluster, the main objective of ownership is the extraction of wood and non-wood products for personal use. Producing wood for fuel is a major objective for these forest owners. This is the third largest cluster with 94 members of which 57.4% are women. This group has the smallest forest holdings (averaging only 6.9 ha) and the closest residing proximity to a holding. The mean distance from forest estate to residence is 18.5 km and around 61% reside in villages. The mean age in this group is 55.4 years. About 45% are located in one of the four most forested counties of Lithuania (Alytus, Vilnius, Utena and Telšiai). The mean duration of possessing a forest holding is 5.6 years, however, the silvicultural activity index is the lowest, at 1.6. The forest owners in this cluster are more passive than in other clusters, even though their level of knowledge in the field of forestry is quite high, the forestry-related knowledge index being 1.2. About 24.5% of forest owners possess their holdings with co-owners.

The main ownership objective of the '*ecologists*' cluster is nature preservation. This is the smallest cluster containing only 75 members. About 63% of owners have a university degree, and 52% are women. The mean size of a forest estate in this cluster is 9.86 ha. About 81% reside in towns or cities. These owners reside the furthest away from their forest estates, the average distance from a forest holding to an owners' residence being 58.5 km. The mean age of the forest owners in this group is 50.3 years. Forty eight per cent live in the four most forested counties of Lithuania (Alytus, Vilnius, Utena and Telšiai). The average time of possessing a forest estate is 5.5 years. The silvicultural activity index is 2.0. The owners representing this cluster are moderately active compared with other clusters, even though their forestry knowledge is the lowest (the forestry-related knowledge index is 0.9). About 24% co-own their holding with other owners and 25.7% acquired their estate by purchasing it.

Comparison of Characteristics across Clusters

Through analysing the cluster characteristics, the dominating factors of one or several owners' groups were identified (Table 4). Seven factors with reliable distribution among clusters were identified: gender of owner, education, place of residence, level of forestry knowledge, forestry-related activity, distance from the residence to the forest holding and the manner of acquiring the forest holding. The majority (55%) of the owners in the '*businessmen*' and '*multi-objective owners*' clusters are men. On the other hand, the clusters of '*consumers*' and '*ecologists*' hold the largest share of women (more than 50%) ($p = 0.0456$). More than 50% of owners in the '*businessmen*', '*ecologists*' and '*consumers*' clusters have university or college level education, while those in the '*multi-objective owners*' cluster might be characterised by their lower degree of education ($p = 0.0000$). Clusters also differ according to the owners' place of residence ($p = 0.0000$). More than 65% of owners forming the '*businessmen*' and '*ecologists*' clusters reside in the cities, while only 39-44% of the owners in the other two clusters are city residents. Owners in the clusters of '*businessmen*' and '*ecologists*' also reside at greater distances from their forest estates.

The respondents were asked to evaluate forestry-related problems. The evaluation was made using the same five-level ordinal scale. The most important problems in

private forestry have been identified as, in decreasing order of importance, the small size of many forest estates, the lack of financial resources for forestry-related activities, the heavy bureaucratic system for forest-related activity documentation, and the lack of silvicultural knowledge (Table 5).

Table 5. Problems related to forest estate management

Problem	Percentage of answers						Mean score
	1 Absolutely not important	2 Not important	3 Neither/ nor	4 Important	5 Very important	Not classed	
Small-sized forest estate	19.6	5.7	10.5	7.1	15.0	42.1	2.86
Forest owners live far away from their forests	26.4	6.8	8.0	5.0	8.0	45.8	2.29
Lack of knowledge and experience in forest management	16.1	5.4	13.1	6.9	13.4	45.1	2.93
Lack of financial resources for forestry-related activities	14.3	5.4	10.2	7.1	18.4	44.6	3.18
Forest-related activity is unprofitable	20.2	7.9	13.3	6.6	6.5	45.5	2.50
Heavy bureaucratic system for forestry-related activity documentation	9.4	2.8	9.9	8.4	24.9	44.6	3.66
Unqualified forest advisors	20.2	5.4	7.9	5.7	8.3	52.5	2.51

The Kruskal-Wallis ANOVA test has been applied to examine whether forest management problems differ between clusters (Table 6). Significant differences at the 5% level were detected for five of the problem types, and the other two (Small-sized forest estates, $p = 0.106$ and Lack of knowledge and experience in forest management, $p = 0.058$) were approaching significance. Rankings of cluster mean Likert scores obtained through the Bonferroni method of multiple comparisons are reported in Table 7.

Table 6. Statistical comparison of importance of forestry-related problems across clusters

Forest management problem	df	K-W H statistic	P-value
Small-sized forest estate	3	6.1	0.106
Forest owners live far away from their forests	3	8.6	0.036
Lack of knowledge and experience in forest management	3	7.5	0.058
Lack of financial resources for forestry-related activities	3	29.5	0.000
Forest-related activity is unprofitable	3	13.8	0.003
Heavy bureaucratic system for forestry-related activity documentation	3	20.3	0.000
Unqualified forest advisors	3	14.5	0.002

Across clusters, the problem of a ‘Heavy bureaucratic system for forestry-related activity documentation’ was evaluated with the highest score. The highest score was given by the *multi-objective owners* (4.11) and the lowest by *ecologists* (3.07). This problem is particularly important to *multi-objective owners* because they carry out intensive and multi-purpose forest management practices (silviculture activity index 2.2).

The second most important problem is a ‘Lack of financial resources for forestry-related activities’. The highest score for this problem was given by the *multi-objective owners* (3.72) and the lowest by the *businessmen* (2.47). The third problem in order of importance is ‘Lack of knowledge and experience in forest management’. This problem was of approximately equal concern across clusters; the highest score was given by *multi-objective owners* (3.21) and the lowest by *consumers* (2.67).

The fourth ranked problem in terms of Likert scores (though not significant by the ANOVA test) is ‘Small-sized forest estate’. This problem is equally important to all groups of forest owners.

The fifth most important problem is ‘Unqualified forest advisors’. The highest score for this problem was given by multi-objective owners (3.09) and the lowest by businessmen (2.25). Qualified consultancy is especially important to multi-objective owners because they conduct multi-purpose forest management. The businessmen’s activities are orientated to income generation from wood and non-wood product sales, and thus consultancy is not complicated.

The sixth problem according to significance is that ‘Forest-related activity is unprofitable’. The highest score for this problem was given by *multi-objective owners* (2.98) and the lowest by *ecologists* (2.14). *Ecologists* do not carry out intensive forest management and as the main goal of their activities is not related to income generation, so this problem is not relevant for them.

Table 7. The problems related to forest estate management mean value by clusters

Forest management problem	Cluster			
	Business-men (a)	Multi-objective owners (b)	Consumers (c)	Ecologists (d)
Small-sized forest estate	2.54	3.00	2.55	3.00
Forest owners live far away from their forests	2.23	2.47 ^c	1.80 ^b	2.07
Lack of knowledge and experience in forest management	2.68 ^b	3.21 ^{ac}	2.67 ^b	2.79
Lack of financial resources for forestry-related activities	2.47 ^{bd}	3.72 ^{acd}	2.90 ^b	3.00 ^{ab}
Forest-related activity is unprofitable	2.25 ^b	2.98 ^{acd}	2.50 ^b	2.14 ^b
Heavy bureaucratic system for forestry-related activity documentation	3.37 ^b	4.11 ^d	3.76 ^d	3.07 ^{bd}
Unqualified forest advisors	2.25 ^b	3.09 ^{acd}	2.48 ^b	2.37 ^b

Note: a, b, c and d indicate pairwise comparisons where the exact p is less than or equal to 0.05.

Links between Grouping of Forest Owners, Private Forest Management Problems and Forest Policy

The new *Policy of Lithuanian Forestry and its Implementation Strategy* was approved in September 2002 by the government of Lithuania. This policy places strong emphasis on forest ownership variety, the participation of society, development and strengthening of international relations, and the efficiency of forestry activity and goals of rural development. The policy and its implementation strategy defines the key instruments for forest policy implementation for the period until 2015. The detailed action plan for the implementation of these instruments from 2003-2006 is already prepared, and implementation has commenced. A number of the objectives in this strategy formulated for private forest management problem-solving are: the development of training for private forest owners; the consulting and education system; correction of non-rational boundaries between the forests of the state and the private sector through equivalent forest property exchanges; introduction of a compensation system due to the restrictions of forest utilisation in newly established protected areas; the integration of private forestry development into the general rural development programs supported by the EU; and support from the state for private forest management.

The Ministry of Environment approved the Education, Training and Advisory Program for private forest owners in 2003. The main objective of this program is to create a basis for a sound forest owner education, training and advisory system which will ensure sustainable forest management (SFM) of private forests. In the program a number of goals have been formulated for the fulfilment of the above-mentioned objective. The Action Plan for 2003-2005 consists of 15 activities and measures for program implementation, including the establishment of regional informational centres and the publication of special education material and literature for private forest owners.

It is recommended that the forest owners classed as '*businessmen*' should be associated with wood trade companies which are members of Forest Owners Association of Lithuania, for example 'Ekomediena' and 'Jungtiniai miškai'. Without an association with wood trade companies the realisation of the forest management aim of these '*businessmen*' is uncertain as their properties are too small. The main education and training subjects for these private forest owners should be a value-maximising harvesting policy, wood market tendencies and new harvesting technologies. Private forest owners of this type need more knowledge about dealing with commercial activity since the main aim of forest management is income generation.

For '*consumers*', a more important subject is progress in the use of wood fuel for heating. The favourable conditions for forest usage focused on recreation and environment protection are important for forest owners classed as '*ecologists*'. The instruments supporting ecological forest management as well as the usage of wood waste for biofuel are not incorporated into the new Policy and Implementation Strategy. '*Multi-objective owners*' are the most active in forest management and all aspects of forest usage are important to this group of private forest owners.

Special attention should be paid to the problems of forest owners by establishing and implementing an education, training and advisory system for private forest owners. (In Lithuania the forest owners' education, training and extension system is still under development and is devolved into different institutions.) Moreover an education, training and advisory system for private forest owners and forest policy should differentiate between the various private forest owners groups.

The greatest problem for all four forest owner groups is the heavy bureaucratic system for forest-related activity documentation. The existing managerial, control and advisory structure could be reformed by orientating it towards an effective solution for the problems. The problem of the 'lack of financial resources for forest-related activities' can be solved in part by using European Union structural funds. The problem of the 'lack of knowledge and experience in forest management' can be solved effectively by implementing the *Education, Training and Advisory Program* and the *Action Plan for 2003-2005*, through which all required means for education and consulting of forest owners are provided.

CONCLUSIONS

A forest owner survey and cluster analysis has allowed four distinct forest owner groups in Lithuania to be identified. The greatest number of survey respondents fall in the '*multi-objective owner*' cluster. For these owners, the income from wood and non-wood products sold, wood for fuel and other own-use purposes as well nature conservation objectives are equally important. Owners in this group actively manage their forests, and have a sound knowledge of forestry. Over half of the owners of this cluster reside in villages relatively close to their forest holdings and these owners possess the largest forest holdings. The main problems for this group of forest owners are the 'heavy bureaucratic system for forestry-related activity documentation' and the 'lack of financial resources for forest-related activities'.

The second biggest cluster is classed as '*businessmen*' and their main objective is income generation from the wood. A characteristic feature of this cluster is that the

owners' residences are spread throughout all regions of Lithuania. More than half of the owners reside in cities and quite far away from their forest estates. Most owners in this cluster actively manage their forests; however, they have a low level of forestry knowledge. The main problems for this group of forest owners are 'heavy bureaucratic system for forestry-related activity documentation' and the 'lack of knowledge and experience in forest management'. There are strong grounds for orientation of consulting and education infrastructure towards this group of forest owners.

The 'consumers' cluster is the third largest. The most important objective of owners belonging to this cluster is wood and non-wood products used for their own purposes. A high proportion reside in the countryside close to their forest estates and thus wood obtained for fuel from their forests is highly important. More than half of the owners in this cluster are women. In general, their forestry activities are passive, and income generation from wood and non-wood products is not a high priority. In consulting and providing services to this group, most attention should be directed towards sustainable management and balancing between economic, ecological and social factors. In future, the relative size of this cluster will probably decrease due to the migration and the changing structure of forest owners. The main problems for *consumers* are the 'heavy bureaucratic system for forestry-related activity documentation' and the 'lack of financial resources for forest-related activities'.

The fourth cluster – '*ecologists*' – is the smallest. The main objective of these owners is nature preservation. These owners have the highest level of education. Over 80% reside in cities and their forest properties are located the greatest distance from their residences. Almost half of the owners from this group do not conduct any management activities in their forests. They also have the lowest level of knowledge in the field of forestry. These are typically residents of the cities and towns and they mostly use their forests for recreational purposes. For owners in this cluster, income generation from wood and non-wood products is not important; however, they still actively manage their holdings. In future this group of owners will probably increase in size due to improving living standards and also the changing structure of forest owners. The main problems for *ecologists* are the 'heavy bureaucratic system for forestry-related activity documentation', the 'lack of financial resources for forest-related activities' and 'small-sized forest estate'.

The grouping used to analyse forest owners may be used for the formation and implementation of a private forest policy. The results of this study suggest that strong emphasis should be put on the creation of an education, training and advisory system for private forest owners and that the focus of forest policy should take into account the different objectives and needs of the various ownership types.

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